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Non–Gaussianity of the atmospheric variability and its relationship with extreme weather events

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Based on the JRA–55 and ERA–Interim reanalyses data for the Northern Hemisphere troposphere, 1976–2014, statistically significant deviations of the atmospheric variability with the synoptic (from 2 to 7 days) and low–frequency (from 9 to 30 days) are found, especially in the regions in which most baroclinic disturbances in the atmosphere are formed — over the western parts of the oceans in midlatitudes. The respective skewness may be either positive or negative depending on variable. For variability with the synoptic time scales, this skewness also depends on the altitude in the troposphere. In turn, the kurtosis excess is positive for all variables, for both time scales of variability, and in all regions and over the whole depth of the troposphere.

The deviations of the atmospheric variability from the Gaussian distribution impact probabilities of extreme events. We found that an approximation to probability distribution function, which is based on the Edgeworth expansion and accounts only for the two leading terms of this expansion, reasonably reproduces such probabilities compared to the reanalysis data.